

# Analysis of the Application of Occupational Safety and Health Signs as an Effort to Reduce Risks in Building Construction Projects

MCPA Islami<sup>1</sup>, RN Sari<sup>2\*</sup>, S Dewi<sup>3</sup>.

Department of Industrial Engineering, Faculty of Engineering, University of Pambangunan Nasional Veteran Jawa Timur, 60294, Indonesia

\*Corresponding e-mail: [rizqi.novita.ti@upnjatim.ac.id](mailto:rizqi.novita.ti@upnjatim.ac.id)

**Abstract.** The construction area is the area that has the most sources of danger. UPN "Veteran" East Java is currently constructing several buildings, such as the addition of lecture halls or the construction of laboratories. The density of the campus area with thousands of students around the construction project makes the risk of danger high. Several cases of students slipping and tripping in the construction area due to scattered building materials, making the application of safety signs need to be considered. This study aims to determine how necessary safety signs are for work safety on the UPN "Veteran" East Java construction project. Where the population used in this activity is students with a sample size of 30 people. The methods used are statistical methods of the ANOVA test, Ergonomic Checklist, and Questionnaire of understanding of safety signs. The results of data processing concluded that the application of OHS signs is needed, especially signs of danger of falling goods, tripping warnings, slipping warnings, and slippery floor warnings.

**Keyword:** Safety Sign; Reduce Risks and Construction Projects.

## 1. Introduction

The number of construction projects at UPN "Veteran" East Java is considered to reduce the productivity and work effectiveness of lecturers, students, and staff employees. Construction project activities also allow work accidents to occur for the workers themselves lecturers-students and staff employees because there are no warning signs so that users cannot avoid activities that allow accidents to occur. Occupational Safety and Health, especially in an industrial environment, is something that can no longer be ignored [1];[2];[3]. Occupational Safety and Health (OSH) is of paramount importance in industrial environments and across all workplaces. Ignoring OSH can lead to serious consequences, including injuries, illnesses, loss of productivity, and financial burdens for both employers and employees [4];[5]. Ensuring the safety and well-being of workers is not only a moral and ethical obligation but also makes good business sense [6];[7];[8]. It is directly or indirectly related to performance improvement strategies, risk minimization, and accident prevention in the workplace. In the end, it is hoped that work effectiveness and efficiency will be realized, leading to increased business profits and avoiding losses.

The definition of a sign is part of the environment that needs to provide information to workers so that their tasks run smoothly. Signs are a common means of communication in various settings, such as workplaces, public spaces, and industrial facilities, and they play a crucial role in ensuring the smooth and safe execution of tasks [9];[10]. The meaning of information here is quite broad, concerning all stimuli received by the human senses both directly and indirectly. Sign is a very important thing in an environment as a source of information for users to complete their tasks or get or achieve certain goals [11];[12]. Sign plays an important role in providing any information for workers, this information is a stimulus obtained by the human senses directly or indirectly [13];[14]. The sign provides information to make it easier for anyone to use. A small example is a sign about danger signs and the importance of maintaining safety for workers so that workers who see the sign will always be careful. Safety signs are vital for promoting a safe working environment and ensuring that workers remain aware of potential hazards. Such signs typically use clear and concise language or universally recognized symbols to convey important safety information [15];[16]. For instance, a common safety sign for this purpose might include a symbol indicating danger (such as a skull and crossbones) along with text that reads "Caution: Safety First" or "Stay Alert, Stay Safe." These signs serve as constant reminders to workers to be cautious and prioritize safety in their tasks. Generally, signs are useful for providing a warning, prohibition, order, and instructions for users of a road or tool to be more careful when doing a job. This research aims to find out how necessary signs are for work safety on the UPN "Veteran" East Java construction project.

The number of incidents of students slipping on slippery project areas due to building materials such as sand and tripping over construction items makes a review of the application of safety signs very necessary. The purpose of this research is to see how important the application of safety signs in construction projects is. Data collection was carried out by distributing questionnaires to 30 student respondents. The data was processed using statistical testing with the ANOVA test. ANOVA is a powerful and widely used statistical test that is employed to compare the means of two or more groups to determine if there are significant differences among them [17];[18]. ANOVA is a valuable tool for researchers and analysts in a variety of fields, including science, social sciences, and business, to determine whether there are significant differences among groups in their data [19];[20]. It helps make informed decisions and draw meaningful conclusions from the data being analyzed.

## **2. Literature Review**

### *2.1 Occupational Health and Safety*

Occupational Safety and Health, especially in industrial environments, is something that can no longer be ignored. This is directly or indirectly related to performance improvement strategies, risk minimization, and accident prevention in the workplace. In the end, it manifests work effectiveness and efficiency which leads to increased business profits and avoided losses.

Occupational safety and health management basically looks for and reveals operational weaknesses that lead to accidents. This function can be performed by:

- 1) Revealing the causation of an accident, and
- 2) Examine whether the careful control is implemented.

Occupational safety and health management considers occupational safety and health planning, namely the cost of accidents and the cost of prevention because these two costs greatly affect the overall production cost and the profits to be obtained. Many construction companies view accidents as accidental or unexpected, therefore not included in the management of construction companies that want to prevent accidents in the future. To reduce loss or damage and to increase efficiency, company must look systematically at the total pattern of accident occurrences.

### *2.2 Ergonomics*

Ergonomics is a science that examines the interface between humans and system components with all human limitations and abilities that emphasize the optimal relationship between the work environment so as to create a good work system in improving performance, safety, and user satisfaction.

Ergonomics can help employees, management, companies, and governments to improve the efficiency of working time, increase the efficiency of muscle and energy use, increase comfort, reduce the risk of work accidents, reduce the risk of occupational diseases, reduce the risk of fatigue, avoid the risk of boredom, reduce employee absenteeism, reduce unexpected costs, reduce man-days/hours and so on which is very beneficial for all parties. Viewed from the engineering side, information on the results of ergonomics research can be grouped into 4 research fields, namely:

1. Research on Display.  
A display is a device that presents information about the environment that is communicated in the form of signs or symbols.
2. Research on Human Physical Strength.  
This research includes measuring human physical strength/power when working and studying how to work and equipment must be designed to match human physical abilities when performing these activities. This research is part of biomechanics.
3. Research on the Size/Dimensions of the Workplace.  
This research is directed to obtain the size of the workplace that corresponds to the size of the human body, studied in Anthropometry.
4. Research on the Physical Environment.  
This research is concerned with the design of the physical environmental conditions of the rooms and facilities where humans work. This includes the design of light, sound, color, temperature, humidity, odor, and vibration in a work facility

### *2.3 Display*

The display is part of the environment that needs to inform workers so that their tasks become smooth. The meaning of information here is quite broad, concerning all stimuli received by the human senses either directly or indirectly. Display is very important in an environment as a source of information for users to complete their tasks or get or achieve certain goals. Display plays an important role in providing any information to workers, this information is a stimulus obtained by the human senses directly or indirectly. The display provides information with the aim of making it easier for anyone to use. A small example is the display of danger signs and the importance of maintaining safety for workers, with that the workers who see the display will always be careful.

The display serves as a communication tool that links between humans and a certain facility. Human daily life relies on the eyes as a sense whose function is to see. The display becomes a support to help humans carry out their duties in everyday life. The display is made to provide the right information to those who see the display. The display is divided into 2 parts, namely Static Display and Dynamic Display. Static displays are displays that provide information without being affected by time variables, such as maps. Dynamic Display is a display that is influenced by time variables, for example, a speedometer that provides motor vehicle speed information in each condition.

### **3. Method**

This research uses a type of quantitative research. The methods used are statistical methods of the ANOVA test, Ergonomic Checklist, and Questionnaire of understanding of safety signs. Where the data in this study is data on the number of questionnaire results regarding the need to install displays for work safety in the UPN "Veteran" East Java project. The source of data used in this study is primary data. Primary data was obtained from distributing questionnaires to UPN "Veteran" East Java students. This research approach is descriptive quantitative, where the data analyzed is in the form of numbers sourced from qualitative data (questionnaires) which are numbered using the Likert scale.

### **4. Results and Discussion**

The data collection method is an activity carried out to obtain information that is treated to achieve the objectives of a research carried out. The method used to collect data in this study was a questionnaire where respondents were UPN "Veteran" East Java students with a sample of 30 people.



*Figure 4. 1 Development Project at UPN "Veteran" East Java*



*Figure 4. 2 Development Project at UPN "Veteran" East Java*



*Figure 4. 3 Development Project at UPN "Veteran" East Java*

Table 4.1. Questionnaire Results

No	Name	Figure Case Studies 4.1		Figure Case Studies 4.1		Figure Case Studies 4.1		Usia	Total
		Do you think the area is unsafe?	How necessary is a pointing display in the area?	Do you think the area is prone to making people ropped/slipped?	How necessary is a pointing display in the area?	Do you think the area is prone to splashes?	How necessary is the display Pointing to the area?		
1	zia	5	5	5	5	5	5	19	30
2	meli	5	5	5	5	5	5	20	30
3	Arif	5	5	5	5	5	5	20	30
4	Nur	4	5	5	5	5	5	20	29
5	dwi	4	5	5	5	5	5	19	29
6	agus	5	5	5	4	4	4	19	27
7	dhia	4	5	5	5	5	4	20	28
8	amin	5	5	4	4	5	5	20	28
9	dafa	5	4	5	5	4	5	19	28
10	refy	5	5	5	4	5	5	19	29
11	farhan	5	5	5	5	5	5	20	30
12	Topik	5	5	5	5	5	5	20	30
13	daniel	4	5	5	5	5	5	19	29
14	Dana	4	5	5	5	4	4	20	27
15	Layin	5	4	4	4	5	5	18	27
16	Hendri	4	4	5	5	5	5	20	28
17	Imah	4	5	5	5	5	5	19	29
18	Chynta	5	5	5	5	5	5	19	30
19	tirex	4	4	5	5	5	5	20	28
20	aiman	5	5	4	4	4	4	19	26
21	zara	5	5	5	5	4	5	19	29
22	jefri	5	5	5	4	5	5	20	29
23	niko	5	4	5	5	5	5	19	29
24	keyzia	5	5	5	5	4	4	20	28

25	finiy	5	5	4	5	5	5	20	29
26	defa	5	5	5	5	5	5	20	30
27	adam	5	5	4	4	5	5	18	28
28	marsha	5	4	5	5	5	4	20	28
29	adam	4	4	5	4	4	4	19	25
30	gaga	5	4	5	5	5	5	20	29

**4.1 Data Processing**

Table 4.2 Results of respondents' answers on the Questionnaire

Problems	Question	Result (scale)	Information
Figure 4.1		1 = 0%	Need for addition Display instructions
		2 = 0%	
	Do you think the area is unsafe and prone to falling objects?	3 = 0%	
		4 = 30%	
		5 = 70%	
	How necessary is a pointing display in the area?	1 = 0%	Need to add Display instructions
		2 = 0%	
		3 = 0%	
4 = 26,7%			
5 = 73,3%			
Figure 4.2	Do you think the area is prone to making people fall/slip?	1 = 0%	Need to add Display instructions
		2 = 0%	
		3 = 0%	
		4 = 16,7%	
		5 = 83,3%	
	How necessary is a pointing display in the area?	1 = 0%	Need to add Display instructions
		2 = 0%	
		3 = 0%	
		4 = 26,7%	
		5 = 73,3%	
Figure 4.3	Do you think the area is prone to mudslides?	1 = 0%	Need to add Display instructions
		2 = 0%	
		3 = 0%	
		4 = 26,7%	



		5 = 73,3%	
	How necessary is a pointing display in the area?	1 = 0%	Need to add Display instructions
		2 = 0%	
		3 = 0%	
		4 = 26,7%	
		5 = 73,3%	

In the display questionnaire for development activities in the UPN "East Java Veterans" area, it was concluded that the three problems in the picture need to be considered because the percentage of respondents' answers answered very affirmatively and really need more than 50%.

#### 4.2 Validity Test

Table 4.3 Correlations

		Correlations						
		G1_rawan_barang_jatuh	G1_perlukah_display	G2_rawan_tergelincir	G2_perlukah_display	G3_rawan_terkena_lumpur	G3_perlukah_display	Total
G1_rawan_barang_jatuh	Pearson Correlation	1	,099	-,293	-,230	-,017	,155	,284
	Sig. (2-tailed)		,604	,116	,221	,928	,414	,129
	N	30	30	30	30	30	30	30
G1_perlukah_display	Pearson Correlation	,099	1	-,067	-,023	,024	,024	,384
	Sig. (2-tailed)	,604		,723	,905	,901	,901	,036
	N	30	30	30	30	30	30	30
G2_rawan_tergelincir	Pearson Correlation	-,293	-,067	1	,539**	-,035	-,035	,339
	Sig. (2-tailed)	,116	,723		,002	,853	,853	,067
	N	30	30	30	30	30	30	30
G2_perlukah_display	Pearson Correlation	-,230	-,023	,539**	1	,202	,202	,567**
	Sig. (2-tailed)	,221	,905	,002		,284	,284	,001
	N	30	30	30	30	30	30	30
G3_rawan_terkena_lumpur	Pearson Correlation	-,017	,024	-,035	,202	1	,627**	,623**
	Sig. (2-tailed)	,928	,901	,853	,284		,000	,000
	N	30	30	30	30	30	30	30
G3_perlukah_display	Pearson Correlation	,155	,024	-,035	,202	,627**	1	,687**
	Sig. (2-tailed)	,414	,901	,853	,284	,000		,000
	N	30	30	30	30	30	30	30
Total	Pearson Correlation	,284	,384	,339	,567**	,623**	,687**	1
	Sig. (2-tailed)	,129	,036	,067	,001	,000	,000	
	N	30	30	30	30	30	30	30

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\*. Correlation is significant at the 0.01 level (2-tailed).

Analysis:

Parameter:

$r_{\text{calculate}} > r_{\text{table}}$  = the item is valid.  
 $r_{\text{calculate}} < r_{\text{table}}$  = the item is invalid.  
 $r_{\text{table}}$   
 $df$   
 $= n - 2$   
 $= 30 - 2$   
 $= 28$   
 $r_{\text{tabel}}$   
 $= 0.3610$

If the significance value  $< 0.05$  = the item is valid.

In table 4.3 it can be seen that all questionnaire items in validity and reliability test is significance value because the value obtained is less than 0.05.

### 4.3 Reliability Test

Table 4.5 Reliability Statistic

Reliability Statistics	
Cronbach's Alpha	N of Items
.664	7

Parameter:

Cronbach's alpha value  $> 0.6$  = the item is reliable. Cronbach's alpha value  $< 0.6$  = the item is not reliable  
 Analysis: The results of the analysis using Cronbach's alpha technique obtained a reliability coefficient of 0.664, so it shows that the data used by the study is reliable or reliable because the value of Cronbach's alpha  $> 0.6$  ( $0.664 > 0.6$ ).

#### Suggested Adding Displays for Case Studies

Here are suggestions for displays that are suitable for each issue:

##### 1. Problem in figure 4.1



Figure 4. 4 Occupational Safety and Health (OSH) Signs Danger of Goods Falling From Above and Be Careful of Tripping

The sign is suitable for the problem in figure 1 because it makes pedestrians more careful when crossing the project area because there are many project materials scattered and in the area there are project material lifting activities with heavy equipment, besides that many project vehicles go in and out of the area. It is recommended that the project contractor and the campus install the display of signs above and provide a special place to place project items so as not to disturb and endanger students and not hamper project work.

##### 2. Problem in figure 4.2

The sign is suitable for the problem in figure 2 because it makes people who want to perform ablation more careful in standing because the base is only a brick that is sometimes slippery and requires more concentration. It is better to move the ablation place to another safer place and put up a sign so as not to approach the area because it is dangerous.



Figure 4. 5 OSH Signs Beware of Slipping



3. Problem in figure 3

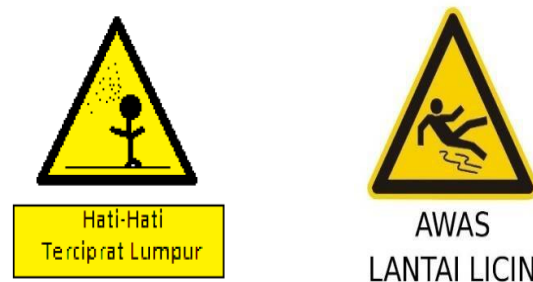


Figure 4. 6 OSH Signs Beware of Mud Splashes and Beware of Slippery Floors

The sign is suitable for the problem in figure 3 because it makes people who want to cross the road can be careful with mud splashes, and mud splashes on the floor will make the floor slippery so pedestrians must be more careful when passing the road. The project party should make the barrier even higher so that mud does not spray on the building and people passing through the road.

## 5. Conclusion

From the results of the questionnaire from a sample of 30 UPN Veteran Jawa Timur students, as many as 30% (9 respondents) Agree and 70% (21 respondents) Strongly Agree that Figure 4.1 is prone to falling goods and as many as 26.7% (8 respondents) Agree and 73.3% (22 respondents) Strongly Agree that Figure 4.1 needs a display. As many as 16.7% (5 respondents) Agree and 85.3% (25 respondents) Strongly Agree that Figure 4.2 Areas are prone to slipping and as many as 26.7% (8 respondents) Agree and 73.3% (22 respondents) Strongly Agree that Figure 4.2 needs a display. As many as 23.3% (7 respondents) Agree and 76.7% (23 respondents) Strongly Agree that Figure 4.3 Areas are prone to mud and As many as 23.3% (7 respondents) Agree and 76.7% (23 respondents) Strongly Agree that Figure 4.3 needs a display.

The solution to the problem obtained that for Figure 4.1 should be added the display "Beware of Falling Goods", "Be Careful of Tripping", and "Be Careful In and Out of Project Vehicles". For Figure 4.2 we recommend adding the display "Be careful of slipping". For Figure 4.3, we recommend adding the display "Beware of Mudsplashes" and "Beware of Slippery Floors". The purpose of adding this display is for Occupational Health and Safety both for employees, project officers, staff, or UPN "Veteran" Jawa Timur students who pass by the area, moreover the area is an area that is often passed.

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